



into the root zone are susceptible to runoff. Percolating water carries the nutrients deeper into the root zone and also removes harmful salts that may accumulate there.

## 7. Soil Crusting

Crusting seals the soil surface and restricts water infiltration and gas exchange. If not allowed to infiltrate, surface applied nutrients on crusted soils are susceptible to runoff and wind transport. Crusting also reduces seed germination and seedling survival which directly has an effect on the plant population and the amount of nutrients necessary for the crop.

## 8. Nutrient Loss or Imbalance

Nutrients need to be applied according to the crop and soil requirements. Soil and plant analyses are a good way to determine the amount of nutrients needed. Over-application of nutrients can lead to plant toxicity, poor pH reaction, and excess nutrients susceptible to runoff, leaching, and volatilization. A deficiency in nutrients will not sustain optimum plant growth.

## 9. Pesticide Carryover

Pesticides with residual soil activity can stunt growth of subsequent crops. If roots are affected, their ability to absorb nutrients will be lessened. Any effect on plant photosynthesis will reduce nutrient uptake and metabolism. Without pesticide or weed control, weeds can utilize nutrients in competition of the crop. The weed residue may not decompose and recycle plant nutrients for the subsequent crops.

## 10. Organic Matter

Soil organic matter is a very valuable component of the topsoil. Organic matter stores nutrients, feeds soil organisms that decompose organic material, and return the basic nutrients to the soil. Organic matter holds soil moisture for plant use. Soil organic matter is developed by combining of carbon, oxygen, and nitrogen plus other nutrients in the soil. Nitrogen and other nutrients must be available to soil microorganisms for development of organic matter.

## 11. Biological Activity

A healthy soil has a diverse set of macro and micro organisms that assure a well functioning soil food web. Microorganisms decompose organic material, store nutrients in their bodies, and as they decay or become food for other organisms, they release nutrients. Some small animals like insects and crustacea carry organic material and related nutrients into the soil and aid in its decomposition. Some microorganisms have a symbiotic relationship with plants such as mycorrhiza. Mycorrhiza live in plant roots and help the plants assimilate water and nutrients.

## 12. Weeds and Pathogens

Nutrients can be used by crops or by weeds. Weeds utilize nutrients, but fail to produce a marketable commodity. So, the nutrients are not efficiently used to grow crops. The same is true for crops that are attacked by disease and insects. Efficient utilization means nutrients are converted to a harvestable product.

## 13. Extreme Soil Moisture Conditions

The amount of soil moisture impacts nutrient cycling. A dry soil does not promote root extension in the root zone. And, since nutrients are carried by water, plants are unable to obtain adequate nutrition. Waterlogged soils affect the transformation of nutrients. Phosphorus becomes more mobile and less attached to minerals in waterlogged conditions. Nitrate nitrogen is denitrified by changing form from a liquid to a gas which can be lost to the atmosphere. Roots consume oxygen and respire carbon dioxide. Because gases are transported much more slowly through water (about one ten thousandth slower) than air, some gases such as carbon dioxide can accumulate in the soil and be toxic to roots.

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